Three Types of Active Lubrication Systems for the Main Bearings of Reciprocating Machines

Santos, Ilmar; Pulido, E. E.

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Three Types of Active Lubrication Systems for Main Bearings of Reciprocating Engines

I. F. Santos & E. E. Pulido

In the paper the authors investigate three different schemes for the realization of the controllable oil injection system to be couple to the main engine bearings. The use of active lubrication in fluid film bearings helps to enhance the hydrodynamic fluid film by increasing the fluid film thickness and consequently reducing viscous friction losses and vibrations. One refers to active lubrication when conventional hydrodynamic lubrication is combined with dynamically modified hydrostatic lubrication. In this case, the hydrostatic lubrication is modified by injecting oil at controllable pressures, through orifices circumferentially located around the bearing surface.
The computed bearing fluid film forces are coupled to the set of nonlinear equations that describes the dynamics of the reciprocating engine, obtained with the help of multibody dynamics (rigid components) and finite elements method (flexible components). The main equations that govern the dynamics of the injection for a hydraulic-actuated, a piezoelectric-actuated and a mechanical-actuated oil injector are presented in this study. The global system is numerically solved using as a case of study a single-cylinder combustion engine, where the conventional lubrication of the main bearing is modified by applying radial oil injection. The performance of such a hybrid bearing is compared to an equivalent conventional lubricated bearing in terms of the maximum fluid film pressures, minimum fluid film thicknesses and reduction of viscous friction losses.